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REMARKS

The Applicants appreciate the Examiner's thorough examination of the subject application. Applicants request reconsideration of the subject application based on the following remarks.

A brief description of the present invention may be of assistance in addressing the rejections set forth by the Examiner under §103.

Claim 1 of the present invention provides a vertical alignment mode liquid crystal display apparatus wherein a side of each of the pair of substrates facing the liquid crystal layer is subjected to a vertical alignment treatment; and the liquid crystal molecules are tilted in a uniform direction from at least one side edge of the at least one electrode to an opposite edge where a voltage is applied to the at least one electrode. The liquid crystal display apparatus of the invention offers greater contrast and higher response speed in comparison with conventional apparatuses. None of the cited references, taken alone or in combination, disclose nor suggest, the technical features provided by the present invention.

More particularly, the present invention is directed to a liquid crystal display apparatus which operates on the vertical alignment (VA) mode in which the liquid crystal molecules are vertically aligned in the absence of applied voltage, and horizontally aligned, i.e., tilted, in the presence of applied voltage. Display apparatus which function based on vertical alignment (VA) of liquid crystalline molecules are significantly different from display apparatus which function based on twisted nematic (TN) mode in which the twist of liquid crystal molecules is altered in response to applied voltage. Moreover, application of a voltage to a TN mode apparatus typically induces rotation or twisting of the liquid crystalline molecules without changing the tilt of the molecules relative to the surface. Thus, the vertical orientation of the liquid crystalline molecules in a TN mode liquid crystal display apparatus is not essential to the cell or pixel operation.

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The present invention, particularly the invention claimed in independent claims 1, 4, and 7, provides liquid crystal display apparatus which operate based on vertical alignment and defection or tilting of the liquid crystalline molecules upon application of a voltage potential. More particularly, claims 1 and 4 provide substrates which are subjected to a vertical alignment treatment (i.e. the liquid crystal molecules are naturally in a vertical orientation), and tilt in a uniform direction (i.e. towards the horizontal) when a voltage is applied to the cell.

The present invention further provides, in claim 7, liquid crystal display apparatus in which those liquid crystalline molecules which are in non-pixel regions of the apparatus are in a uniaxial (i.e. not twisted) horizontal alignment. Such an alignment facilitates vertical-horizontal transition of liquid crystalline molecules present in the pixel region of the display apparatus.

Claims 1, 2, and 4-6 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Hirata et al (U.S. Patent 5,872,611) in view of Colgan (U.S. Patent 6,256,080).

Claims 7-14 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Hirata et al (U.S. Patent 5,872,611) in view of Colgan (U.S. Patent 6,256,080) as applied to claims 1, 2, and 4-6 above, and further in view of Numano (U.S. Patent 6,313,898).

For the sake of brevity, the two § 103 rejections are addressed in combination. Such a combined response is considered appropriate because *inter alia* each of the rejections relies on the Hirata as the primary citation in view of Colgan as a supporting citation. Each of the rejections is traversed.

In the TN device recited by Hirata, the orientation of liquid crystal molecules relative to the surface is substantially constant during device operation. Instead, the liquid crystalline molecules rotate or twist, like the hands of a clock, upon exposure to an applied field. That is, the liquid crystalline molecules rotate along a (roughly vertical) helical axis under the influence of an applied field so as to switch between a twisted and untwisted orientation while maintaining an alignment relative to the surface of a small angle δ (i.e. roughly horizontal). As shown in Fig.

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27, the volume excluding member 47 of the Hirata device prevents the liquid crystalline molecules from aligning in opposite directions thereby improving the viewing angle characteristic of the recited TN device.

In contrast, Colgan teaches a liquid crystalline display device operating in a vertical alignment mode (VA mode) where liquid crystal molecules are aligned roughly vertically, and rotate around a horizontal axis under the influence of an applied field, so as to switch between a vertical and horizontal orientation as shown in Fig. 3 of Colgan.

As can be seen, the two devices operate on completely different physical principles and represent completely non-analogous ways of solving the problem of increasing viewing angle. One skilled in the art would simply not try to apply the features of vertical alignment treatment and negative dielectric anisotropy of Colgan to the TN system of Hirata because a vertical alignment would completely disrupt the TN mode of the LCD device recited by Hirata which requires twisted liquid crystal molecules aligned roughly horizontally. Thus, the combination of documents proposed by the office action results in an inoperable LCD device, e.g., one skilled in the art would not reasonably predict that an LCD device based on any combination of the Hirata and Colgan teachings would be provide any technical advantages over the recited Hirata or Colgan documents.

The devices of Colgan and Hirata function by taking advantage of different physical phenomena. That is, Hirata uses a device architecture designed to enhance twisting of the liquid crystalline molecules to improve viewing angle and Colgan recites a device operating by changing the vertical alignment of the liquid crystalline molecule. The office action alleges that one skilled in the art would modify the TN mode LCD device recited by Hirata with the technical features of the VA mode LCD device recited by Colgan. However, the office action fails to provide any motivation for such a combination. As provided by MPEP 2143.01, the

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addition of the supporting documents can not change the principle of operation of the device recited in the primary reference.

MPEP 2143.01, THE PROPOSED MODIFICATION CANNOT CHANGE THE PRINCIPLE OF OPERATION OF A REFERENCE

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). The court reversed the rejection holding the "suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [the primary reference] as well as a change in the basic principle under which the [primary reference] construction was designed to operate" 270 F.2d at 813, 123 USPQ at 352.

Thus, the proposed modification of the TN mode LCD device taught by Hirata to function in a VA mode by combination with the Colgan document results in a change in the principle of operation of the Hirata LCD device (e.g., from TN mode to VA mode). Thus the office action has failed to establish a *prima facie* case of obviousness based on Hirata and Colgan.

Notwithstanding the incompatibility of the Hirata and Colgan references, one skilled in the art would only have combined the teachings of Colgan to improve that TN mode LCD device of Hirata. That is, one of ordinary skill in the art would not have been motivated at the time the invention was made to modify the TN mode LCD device recited by Hirata into a VA mode LCD device merely based on the Colgan teachings. Thus, even if the references are combined, the combined teachings are merely directed to a modified TN mode LCD device.

The Numano document fails to overcome the limitations of any combination of Hirata and Colgan. That is, Numano, as the office action is understood, is merely relied upon for a

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teaching of using polarized UV rays to induce a uniaxial horizontal alignment of the non-pixel portion of the LCD display.

None of the references cited in the Office Action, taken alone or in combination, disclose or suggest the liquid crystalline display apparatus provided by the present invention.

Thus, for at least the reasons discussed *supra*, the claims as amended, which provide a vertical alignment mode LCD apparatuses would not have been obvious to one skilled in the art based on any combination of Hirata, Colgan, and/or Numano. Thus claims 1, 4, and 7 are patentable over any combination of Hirata, Colgan, and/or Numano. Claims 2,3, 4-6, and 8-14 depend from one of claims 1, 4, and 7 and are therefore also patentable over any combination of Hirata, Colgan, and/or Numano.

Although it is not believed that any additional fees are needed to consider this submission, the Examiner is hereby authorized to charge our deposit account no. 04-1105 should any fee be deemed necessary.

Respectfully submitted,



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